



Attorney Docket No. 09792909-5727

PATENT

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Applicant: Hirata, K.

Serial No.: 10/705,552

Filed: November 11, 2003

For: SOLID-STATE IMAGING DEVICE AND  
METHOD FOR MANUFACTURING THE  
SAME

Case No.: 09792909-5727

Examiner: Nguyen, J. H.

Group Art Unit: 2815

Confirmation No. 5105

**Certificate of Mailing (37 CFR 1.8(a))**

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Roxanne Swartz

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

**DECLARATION OF RYOICHI DANSHO UNDER 37 C.F.R. §1.131**

Dear Sir:

1. I, Ryoichi Dansho, am a patent engineer employed in the Intellectual Property Department of Sony Corporation ("Sony"). In the course of my employment for Sony, I was responsible for the preparation and filing of Japanese Patent Application No. P2002-330150, which was filed on November 14, 2002.

2. This declaration is submitted to show the steps I took between August 20, 2002 and November 14, 2002 in preparing and filing Japanese Patent Application No. P2002-330150 and my work load during that time.

3. In 2002, my duties included, among others, performing a review of submitted invention reports to determine whether to file a patent application. The initial review of an invention report included evaluating the level of importance of the invention, checking the novelty of the invention, and judging the necessity of the patent application. Based on these and other factors, a decision was then made on whether to file a patent application on the invention.

4. In 2002, I evaluated 105 different invention reports. A list of the matters I was in charge of, and their corresponding patent application numbers, is attached as Exhibit A.

5. If a decision to file a patent application was made, I would then conduct discussions with both the inventor and a patent attorney in charge of drafting the patent application. The patent application would then be prepared based on the disclosed invention. Once a draft was prepared, the inventor and I would review the draft application and make any necessary additions or edits.

6. My work is typical of that of other patent engineers within Sony in that about 20 percent of my time is allocated to the review of new invention reports and the evaluation of them for application preparation purposes. The subsequent preparation of an application generally takes about an additional 2 months for a typical solid-state imaging device patent application.

7. Before August 21, 2002, I received an Invention Report from Kiyoshi Hirata ("Hirata Invention Report"). A translated copy of the Hirata Invention Report is attached hereto as Exhibit B. I understand that a copy of this Invention Report, as well as a certification of translation, was also provided to the examiner on August 4, 2005 with the declaration of Kiyoshi Hirata.

8. The Hirata Invention Report disclosed a method of manufacturing a solid state imaging device including forming a photosensor in the surface of a substrate (see e.g., page 2 of translated Invention Report, which states that "electric charges, into which received light is photo-electrically converted, are mixed with adjacent pixels . . ."), and forming a channel stop section on the side of the photosensor in the substrate by multiple times of ion implantation with multiple implantation energies (see e.g., page 1 of translated Invention Report, referring to "A channel stop structure in which multiple-stage implantation is carried out . . . by changing energy."), wherein the ion implantation area and/or the ion concentrations may be changed. (See, e.g., page 1 of Invention Report, items 3 and 4).

9. After receiving the Hirata Invention Report, I proceeded to perform the usual and customary evaluation to determine whether a patent application on the disclosed invention was warranted and feasible in view of its novelty and importance. Based on my evaluation, a decision to proceed in filing a patent application was made on September 3, 2002. This is indicated in the Invention Report in the field next to "[Date of Decision]" on page 4.

10. A patent application based on the Hirata Invention Report was ultimately filed approximately two months later on November 14, 2002, nearly immediately after the patent application was completed.

11. Between September 3, 2002 and the time of the filing, the patent attorney, Kyoshi Hirata, and myself worked diligently and expeditiously to prepare and file the Japanese patent application. After a decision was made to prepare a patent application, I had discussions with Kiyoshi Hirata and the patent attorney regarding the invention. The patent attorney then began drafting the specification and claims of the patent application. The drawings for the patent application were completed on October 3, 2002, as indicated on page 2 of the Hirata Invention Report in the fourth row under the heading "List of Attached Documents." The draft patent application was then reviewed by myself and Kiyoshi Hirata. The correction and editing of the application was completed on November 6, 2002, as indicated on page 2 of the Hirata Invention Report in the fifth row under the heading "List of Attached Documents." The patent application was then filed less than one week later on November 14, 2002.

Declaration of Yoshinori Tomita  
Application No. 19/905,424  
Page 4

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Ryoichi Dansho  
Ryoichi Dansho

April 27, 2006  
Date

# Cases in 2002

Reference Number	Application Number
2000372	2002171805
2000424	2002168942
2000497	2002183383
2001048	2002371415
2900088	2002080056
2900117	2002127855
2900120	2002087477
2900539	2002067896
2900684	2002148183
2900688	2002102108
2900791	2002235521
2900863	Not filed
2900871	2002183451
2901070	2002102046
2901082	Not filed
2901628	2002237838
2901756	2002307571
2901758	2002345252
2901895	2002165127
2901918	Not filed
2901924	Not filed
2901925	Not filed
2901926	Not filed
2901928	2002284352
2902295	2002235689
2902560	Not filed
2902596	Not filed
2902597	2002274557
2902615	2002285452
2902626	2002334085
2902634	Not filed
2902636	Not filed
2902702	2002138638
2902744	2002144886
2902830	2002243053
2902834	2002185464
2902835	2002302528
2902836	2002235125
2902866	2002335217
2902965	2002182408
2903074	Not filed
2903115	2002285827
2903116	2002326358
2903135	Not filed
2903157	2002339394
2903182	2002169577
2903193	2002208186
2903259	2002289658
2903264	Not filed

2903265	Not filed
2903271	2002322005
2903301	2002301677
2903303	Not filed
2903304	Not filed
2903332	2002220001
2903355	Not filed
2903490	2002307298
2903639	Not filed
2903712	Not filed
2903750	Not filed
2903758	Not filed
2903873	2002338868
2903874	2002338869
2904328	2002310637
2904330	Not filed
2904403	2002157055
2904546	2002169862
2904731	2002163134
2904741	2002108486
2905432	2002324613
2905436	2002373745
2905557	2002302873
2906070	2002336252
2906177	2002373414
2906283	2002291962
2906443	2003035470
2906582	2002329727
2906677	2002344833
2906743	2002371254
2906941	2003019888
2906951	2003074108
2906955	2003103699
2906976	2003099876
2907065	2003104324
2907076	2003060328
2907155	2003045032
2907159	2003080409
2907170	2002363261
2907426	2002373415
2907683	2002319506
2907762	2002319505
2907774	Not filed
2908335	Not filed
2908337	2003150107
2908339	2003075906
2908340	2003207749
2908341	2003100750
2908342	Not filed
2908344	2003136753
2908345	2003070750
2908347	2003127673

2908348	Not filed
2908359	2003132611
2908432	Not filed
2908634	Not filed

## &lt;INVENTION REPORT&gt;

## •Proposer Information

[Company Code]	[Inventor Code]	[Proposer Name]	[Belonged Section Name]
000218	100181	Kiyoshi HIRATA	IMNC· PAC· Planning Dept.. Planning

## ■ Inventor Filling Space ■

[Receipt Number]	02903751	[Date of Receipt]	
[Proposal Number]	200203-1636	[Date of Submission]	
[Title of Invention]	Manufacturing Method of Solid-State Imaging Device		
[Summary of Invention (Invention Department)]	As to a channel stop section which is used for partitioning off a pixel section in a solid-state imaging device, a conventional structure is of the structure that P type impurities are formed by identical energy, whereas in this invention, that structure is changed to another structure that energy is changed and ion implantation is carried out several times, so that it is possible to reduce a smear component which occurs due to a pixel peripheral surface side, and to suppress the color mixture phenomenon that adjacent pixel and photo-electrically converted electric charges are mixed. In addition, by changing an area to which ion implantation is applied with each energy, it is possible to suppress the above-described phenomenon without narrowing a pixel area. It is the invention.		
[Project Name]	01-PJ-108	[Model Number]	0000000
[Model Name/ Development Type Name]			
[Software Classification]		[Development Status]	Development/Trial Production Stage
[Publicity Plan]	No	[Examination Request at the time of Filing (Proposer)]	Desired
[Scheduled Day of Publicity]		[Method of Publicity]	



## ●Inventor

No	Report Preparation	Inventor Information (Registered)	Inventor Information (Unregistered)	Shared Authentication ID
1	Report Preparation	Company : 000218 Sony Corporation IMNC· PAC· Belonging : NIM409D Planning Dept.· Planning Inventor : 100181 Kiyoshi HIRATA Kiyoshi HIRATA E-mail : kiyoshi@shiba.sony.co.jp Tel : ( Common to Registered· Unregistered )	Company Name : Belonging Name : KANA Name : KANJI Name : E-Mail :	Obtained

## ●List of Attached Documents

Type	File	Size	Prepared Date	Receipt Number of Combined Child Matter
Inventor Manuscript	Channel stop multiple state implantation.doc	55,296	00:14:14	
Invention Report at the time of Receipt	Invention report at the time of filing.htm	10,781	12:38:57	
Drawing	02903751.tif	438,784	2002.10.03 16:24:02	
Check/Correction Material	Channel stop multiple state implantation (revised).doc	47,104	2002.11.06 16:38:05	
Others	Modified manuscript.doc	45,568	2002.11.12 15:09:37	
	Modification instruction.doc	36,864	2002.11.12 15:14:37	

## ●Prior Art Search

[Search Means] IP-NAVI

## ●Inventor Comment

Searched by Channel Stop, Multiple Implantation, High Energy, but not found.

Documents to be sent separately

[List of paper documents to be sent separately]

■ Immediate Manager Filling Space ■

[Company Evaluation]	Priority Processing	[Foreign Filing Desire]	TBD
[Examination Request at the time of Filing ( Invention Department ) ]		Not desired	
[Department Comment]	Particularly effective at the time of cell miniaturization		

■ Patent Staff Filling Space ■

[Receipt Number]	0290375 1	[Date of Receipt]	[REDACTED]		
[Filing Type]	Normal Filing	[Detailed Classification]			
[Own company/ Other company Classification]	Own company filing	[Original Classification]	First Country	[Filing Procedure Classification]	Own company management
[Title ( IP Dept. ) ]	Manufacturing Method of Solid-State Imaging Device				
[Summary of Invention ( IP Department ) ]	<p>As to a channel stop section which is used for partitioning off a pixel section in a solid-state imaging device, a conventional structure is of the structure that P type impurities are formed by identical energy, whereas in this invention, that structure is changed to another structure that energy is changed and ion implantation is carried out several times, so that it is possible to reduce a smear component which occurs due to a pixel peripheral surface side, and to suppress the color mixture phenomenon that adjacent pixel and photo-electrically converted electric charges are mixed. In addition, by changing an area to which ion implantation is applied with each energy, it is possible to suppress the above-described phenomenon without narrowing a pixel area. It is the invention.</p>				
[Free Keyword]					
[JK Keyword]					

[Described Content Evaluation]	Class 1 : Within Regulation			
[Evaluation Comment]				
[Network Company]	SNC SNC	[Company]	NSN1 NSN1	
[Group in charge]	GR GR/Semiconductor Fundamental Device Technology GP			
[Person in charge]	110221 Kyoichi DANTOKO			
[Importance Level Evaluation]	Acceptance Period 0203	Region Classification	Acceptance/Basic Handling Staff KL	Handling Staff kl
[4 Laws]	Patent	[Examination Request at the time of Filing ( IP Department ) ]	No	
[Number of Claims]		[Number of Actual Inventions]	[Request Rank]	B2
[Office]	ML00 NODA Patent Office			
[Writer]	ML02 Osamu GAMON			
[Office Request Classification]	Filing Request	[Due Date]	2002.11.15	
[Request Content]	There is a correction. Please FAX before going through procedure. We will confirm.			

●Final Disposal

Disposal Name	Relevant Information
Filing	Filing Number : 2002330150 Filing Date : 2002.11.14
[Date of Decision]	2002.09.03 [Reason of Decision]

●Child Matter

No	Receipt Number	Final Approval
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●Applicant

No	Company Name	In charge of Handling	Quota	Detail Input
		Classification		
1	000218 Sony Corporation	In charge of Handling	100%	Company Name : Representative Name : Postal Code : Address : Contact Point Tel : Remark :
		Right Holder (Applicant)		

•Domestic Priority Filing

No	Number Type	4 Laws	Number
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•Original Invention ( Division Information )

Number Type	4 Laws	Number
	Not specified	

•Relevant Invention

No	Number Type	Country	4 Laws	Number	Type
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•Comment

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[An inventor should make a copy of this paper and keeps it for himself/herself.]

[INVENTION REPORT (2)]

[Point of Invention]

This is a portion which becomes a column of [Scope of Claim for Patent] (Claims) in a specification of an application. When there are a plurality of points of an invention (claims), please write all of them with addition of items 1, 2, 3, ... .

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1. A channel stop structure in which multiple-stage implantation is carried out between vertical direction pixels, by changing energy.
2. A channel stop structure in which multiple-stage implantation is carried out between horizontal direction pixels and a vertical transfer section.
3. A channel stop structure in which ion implantation is carried out by changing a size with respect to each energy for channel stop.
4. A channel stop structure in which ion implantation is carried out by changing P type impurity concentration at each energy.

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[Prior Art and its Problem]

This is a portion which becomes a column of [Prior Art] in the specification of the application. Please write prior art and its drawback by citing patent publications, documents etc. as far as possible.

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By the matter that a pixel size becomes smaller in an imaging device, a space between a vertical direction pixel and a horizontal direction pixel is narrowed, and in case of a conventional channel stop structure, there occurs the phenomenon that electric charges, into which received light is photo-electrically converted, are mixed with adjacent pixels (hereinafter, called as color mixture phenomenon). In order to prevent the phenomenon, there is need to heighten energy for channel stop, but when energy is heightened to carry out ion implantation, it leads to deterioration of a smear phenomenon due to a surface side.

In addition, by the matter that energy is heightened to carry out ion implantation, it becomes easy to occur diffusion of P type impurities, so that an electric charge storage area is narrowed and lowering of sensitivity and lowering of saturation signal quantity are brought about.

[INVENTION REPORT (3)]

[Concrete Explanation of Invention]

This is a portion which becomes a column of [Embodiment] in the specification of the application. Please explain in detail in accordance with the following procedures.

1. Please write an embodiment (apparatus/system in which the invention is used and entirety of a substantial section) which you believe is the best in order to realize this invention
2. Please write structures, operations, workings of substantial sections of the invention in detail as far as possible.
3. Please write modification examples of the invention as many as possible.

Note 1: Please write drawings, graphs, flow charts, etc. with reference numbers on attached separate papers, and please write explanations over citing the reference numbers.

Note 2: In case that there are technical reports etc., please actively make use of them for supplement of the explanations.

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One example of a cross section of a structure of an imaging device sensor section is shown in Fig.1 (cross section in a

vertical direction), Fig.2 (cross section in a horizontal direction).

Normally, there is a possibility that, by expansion of an electric charge storage section (14) in a vertical direction (Fig.1), a space between pixels is narrowed and (15), in which there is no channel stop portion between pixels or ion implantation is applied only to its surface, is overlapped with an adjacent pixel to bring about a color mixture phenomenon. In addition, in a horizontal direction (Fig.2), in the same manner, there is a possibility that, by expansion of an electric charge storage section (24), (25), in which ion implantation is applied only to its surface, is overlapped with an adjacent pixel to bring about a color mixture phenomenon.

In order to suppress the color mixture phenomenon, there is need to apply ion implantation of P type impurities to a channel stop portion, deeply in a bulk depth direction, by increasing energy.

In case that ion implantation is simply applied deeply in a bulk depth direction, concentration of P type impurities on a surface side for suppressing a smear component which occurs on a surface, becomes thinner, and it becomes easy to occur the smear phenomenon.

A structure of applying ion implantation of P type impurities to horizontal direction and vertical direction channel stop



portions on multiple stages by changing energy, in order to suppress the smear component on the surface side and to suppress the color mixture phenomenon.

In addition, such a structure that, on the occasion of carrying out ion implantation on multiple stages, energy is heightened as represented by Fig.3, and thereby, an area of a portion to which ion implantation is applied is narrowed, and an area in which diffusion occurs at a deep portion in a depth direction is narrowed as much as possible, so as not to narrow a storage area.

As described above, by configuring the multiple stage channel stop portion, an advantage of suppressing a Qknee phenomenon which is brought about by increase of photo-electrically converted electric charges is expected, besides suppression of the smear component on the surface side and suppression of the color mixture phenomenon with an adjacent pixel.

[INVENTION REPORT (4)]

[Concrete Explanation of Invention] (continuation)

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[Advantage of Invention]

This is a portion which becomes a column of [Advantage of the Invention] in the specification of the application. Please write advantages of the invention, which are predicted, as many as possible.

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There is an advantage of preventing the color mixture phenomenon that photo-electrically converted electric charges are mixed with adjacent pixels, by carrying out multiple stage ion implantation, with changing energy of a channel stop between vertical direction pixels and a channel stop between a horizontal direction electric charge storage section and a vertical transfer section.

An advantage of preventing the color mixture phenomenon without narrowing an electric charge storage area and without lowering sensitivity and saturation signal quantity, by

reducing a size of ion implantation by high energy.

An advantage of reducing fluctuation of an overflow barrier at the time that electric charges were stored and preventing Qknee, by applying ion implantation to a channel stop with high energy.

An advantage of suppressing a smear phenomenon due to a surface side and a smear phenomenon due to an inside of a bulk, by realizing the configuration that ion implantation is applied to a channel stop between a horizontal electric charge storage section and a vertical transfer section by changing energy.

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[When a paper space is not enough, please make use of an arbitrary paper such as a report writing paper, and write in detail as far as possible.]

## [INVENTION REPORT (5)]

## [Drawing]

As a general rule, please make use of this drawing writing paper. In this regard, however, if there is an existing drawing such as a design drawing, a CAD drawing, and a specification sheet, there is no problem to make use of it. In addition, there is also no problem to make use of it together with this drawing writing paper.

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[Fig.1]

[Fig.2]

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[When a paper space is not enough, please make use of an arbitrary paper such as a report writing paper, and write in detail as far as possible.]

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[Fig.3]